National Institute of Environmental Health Sciences

Temperature, viral genetics, and the transmission of West Nile virus by Culex pipiens mosquitoes

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Abstract:

The distribution and intensity of transmission of vector-borne pathogens can be strongly influenced by the competence of vectors. Vector competence, in turn, can be influenced by temperature and viral genetics. West Nile virus (WNV) was introduced into the United States of America in 1999 and subsequently spread throughout much of the Americas. Previously, we have shown that a novel genotype of WNV, WN02, first detected in 2001, spread across the US and was more efficient than the introduced genotype, NY99, at infecting, disseminating, and being transmitted by Culex mosquitoes. In the current study, we determined the relationship between temperature and time since feeding on the probability of transmitting each genotype of WNV. We found that the advantage of the WN02 genotype increases with the product of time and temperature. Thus, warmer temperatures would have facilitated the invasion of the WN02 genotype. In addition, we found that transmission of WNV accelerated sharply with increasing temperature, T, (best fit by a function of T(4)) showing that traditional degree-day models underestimate the impact of temperature on WNV transmission. This laboratory study suggests that both viral evolution and temperature help shape the distribution and intensity of transmission of WNV, and provides a model for predicting the impact of temperature and global warming on WNV transmission.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2430533

Resource Description

Early Warning System:

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

United States

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: West Nile Virus

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Short-Term (

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content